Attorney Docket 8039-1002
PATENTS

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re application of

Masanobu HIDEHIRA et al. Appeal No. _____

Serial No. 10/081,238 GROUP 2871

Filed February 25, 2002 Examiner Jeanne A. DiGrazio

LIQUID CRYSTAL DISPLAY DEVICE AND ITS MANUFACTURING METHOD

APPEAL BRIEF

MAY IT PLEASE YOUR HONORS:

1. Real Party in Interest

The real party in interest in this appeal is the Assignee, NEC LCD Technologies, Ltd. Of Kanagawa, Japan.

2. Related Appeals and Interferences

Neither the appellant, appellant's legal representative nor the assignee know of any other prior and pending appeals, interferences or judicial proceedings which may be related to, directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

3. Status of the Claims

Claims 1, 3-9 and 11-15 are pending. Claims 2 and 10 were cancelled by the amendment of January 29, 2004. Claims 1, 3-9 and 11-15 are rejected, from whose final rejection this appeal is taken.

4. Status of Amendments

In response to the final rejection of June 29, 2004, Applicant filed an amendment on October 7, 2004. The ensuing Office Action of November 3, 2004 indicated that claims 1, 3-9 and 11-15 would not be entered because the amendment to claim 13 raises new issues requiring further consideration. Accordingly, the claims on appeal are 1, 3-9 and 11-15, as set forth in the Appendix, with claim 13 provided in clean form and in marked-up form to include the subject matter that the Examiner indicates raises new issues.

5. Summary of Claimed Subject Matter

The invention relates to a liquid crystal display device and a method of manufacturing the device. An insulating layer of the device has a plurality of insulating films that have a tapered contact hole therethrough. A black matrix lies outside the contact hole and over the insulating layer. The insulating layer and the black matrix are formed in such a manner to help prevent disclination, which is an alignment defect in which

discontinuity occurs in the alignment direction of liquid crystal molecules due to a level difference in the alignment surface of liquid crystal, distribution of an electric field and an abrupt change in a driving voltage.

As disclosed on page 9, lines 18 to page 10, line 11, in conjunction with Figures 1 and 2, a passivation layer 104 is formed on a wiring layer. A color layer 105 is formed on passivation layer 104. A black matrix 16 is formed on the color layer 105. An overcoat layer 106 is formed on the color layer 105 and the black matrix 16. The passivation layer, the color layer and the overcoat layer are a plurality of insulating films, which form the insulating layer.

As disclosed on page 10, lines 14-26, in conjunction with Figure 2, a contact hole 18 is formed in the passivation layer 104, color layer 105 and overcoat layer 106. The contact hole 18 comprises an opening 104a of the passivation layer 104, an opening 105a of the color layer 105 and an opening 106a of the overcoat layer 106. The openings 105a and 106a are formed in a gentle taper shape. As disclosed on page 12, lines 16-24, the contact hole 18 is formed on a region where disclination occurs and ensures that a higher aperture ratio can be obtained.

As disclosed on page 12, line 25 to page 13, line 7, the black matrix 16 has a wide portion 16a between a portion 14b of a source line 14 and an adjacent data line 13 to also obtain a

higher aperture ratio. The higher aperture ratio obtained by the insulating layer and the black matrix arranged in this manner offsets the effects of disclination.

The invention defined in independent claim 1 is an insulating layer formed of a plurality of laminated insulating films. The insulating films have openings individually which form a tapered shape as a whole.

Independent claim 9 is a method claim and includes similar features to claim 1 and is not argued separately.

Independent clam 13 is also a device claim and provides that the black matrix has a wide portion overlapping a region in a pixel between a data line and a projecting portion.

6. Grounds of Rejection to be Reviewed on Appeal

Claims 13-15 stand rejected under 35 USC 112, second paragraph as being indefinite. Claims 1, 3-9 and 11-15 stand rejected under 35 USC 103(a) as being obvious over SHIMADA et al. 6,147,722 in view of ZHANG et al. 6,115,088.

7. Arguments

Arguments Concerning the First Ground of Rejection

Claims 13-15 stand rejected under 35 USC 112, second paragraph as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The position set forth in the Office Action of June 29, 2004 is that the Examiner is unable to determine what is meant by "the projecting portion" and to what "the projecting portion" refers.

However, this position cannot be maintained for at least two reasons.

First, "the projecting portion" of claim 13 is used in the same manner as originally recited in claim 6, wherein a "scanning line has a projecting portion". This is evidenced by the Remarks on page 13 of the amendment filed January 29, 2005.

In this part of the Remarks, it was stated that, "the comments above regarding claim 7 are equally applicable to claim 13". Claim 7, which depends from claim 6 includes the same limitation as claim 13: "wherein said black matrix has a wide portion overlapping a region in the pixel between said data line and the projecting portion".

At the personal interview conducted with the Examiner on October 6, 2004, Applicants' representative emphasized this intended construction of claim 13 and stated that similar to claim 6, claim 13 should be interpreted so that the scanning line has a projecting portion. Claim 13 was amended accordingly in the response filed October 7, 2004 to clarify this intent.

Second, MPEP 2173.02 in providing guidance for determining definiteness sets forth that:

> The essential inquiry pertaining to this requirement is whether the claims set out and circumscribe a particular subject matter with a reasonable degree of clarity and particularity. Definiteness of claim language must be analyzed, not in a vacuum, but in light of:
>
> (A) The content of the particular application disclosure;
>
> (B) The teachings of the prior art; and
>
> (C) The claim interpretation that would be given by one possessing the ordinary level of skill in the pertinent art at the time the invention was made.

The present specification only refers to the scanning line having a projecting portion. No other line or element is disclosed as having a projecting portion.

The cited reference to SHIMADA et al. teaches an extended drain electrode 125 extending from a scanning line as seen in Figure 27.

Interpreting the claim as a whole and based on the present specification including the drawings, one of ordinary skill in the art would have interpreted the recited: "said black matrix has a wide portion overlapping a region in the pixel between said data line and the projecting portion" to mean that the wide portion is overlapping a region defined by the data line and the scanning line. Thus, one of ordinary skill in the art would have interpreted that "the projecting portion" was projecting from the scanning line.

Therefore, the Examiner should have been able to determine what is meant by "the projecting portion" and to what "the projecting portion" refers. Accordingly, amending claim 13 in the response filed October 7, 2004 to clarify that, "the

projection portion extends from the scanning line" is believed to address the indefiniteness rejection without presenting a new issue that requires further consideration and/or search.

Arguments Concerning the Second Ground of Rejection

Claims 1, 3-9, 11 and 12-15 are rejected as unpatentable over SHIMADA et al. 6,147,722 in view of ZHANG et al. 6,115,088.

The position of the Examiner is that SHIMADA et al. do not appear to teach that the insulating layer is formed of a plurality of laminated insulating films and that the insulating films have openings individually which form a contact hole in a tapered shape as a whole. The Examiner offers ZHANG et al. in an attempt to overcome this shortcoming. The Examiner points out that ZHANG et al. in column 4, line 66 through column 5, line 9 in conjunction with Figures 9B and 9C teach an insulating film made of laminate films 904 and 905.

The Examiner concludes that it would be obvious to one of ordinary skill in the art to use the laminated insulating films of ZHANG et al. and a tapered shaped contact hole to contribute to a display in which a drop in pixel aperture ratio is prevented and cross-talk is suppressed. The Examiner offers column 6, lines 61-12 of ZHANG et al. in support of her conclusion.

Nonetheless, the Examiner's conclusion cannot be maintained for at least four reasons.

First, Applicants have thoroughly reviewed ZHANG et al. and are unable to discern any teaching regarding a tapered shape contact hole. Specifically, as seen in Figure 9C of ZHANG et al., for example, contact hole 111 has parallel sides.

Second, the contact hole of ZHANG et al. is formed in such a way that the pixel electrode does not contact a wiring layer through the contact hole as required by claim 1. As seen in Figure 10 of ZHANG et al. source line 105 (wiring layer) is in contact hole 111, not that the pixel electrode is formed on the insulating layer and electrically connected to the end portion of a wiring through the contact hole as recited in claim 1.

Further, the recited insulating layer is arranged such that the pixel electrode is on the insulating layer. The pixel electrode 107 of ZHANG et al. is on layer 907, not on laminated layers 904,905. Layer 907 is neither a laminated layer nor has a contact hole there through so that the pixel electrode is in contact with the wiring through the contact hole as required by claim 1.

Third, the Examiner's source of motivation for combining the references is not relevant to the elements for which ZHANG et al. is cited. Column 5, lines 29-32 of ZHANG et al. teach that by overlapping the edge of the pixel electrode 107

(as seen in Figure 10 of ZHANG et al.) with the source line and the gate line, the overlapped region functions as a black matrix. Thereby, the aperture ratio may be increased to the maximum.

Accordingly, it is the overlap of the pixel electrode 107 with source line 105 that maximizes the aperture ratio. The laminated insulating layer 904, 905, for which ZHANG et al. is offered, is beneath the source line, and does not appear to affect the aperture ratio.

Column 5, lines 33-47 of ZHANG et al. further discloses that a required capacity may be obtained without dropping the aperture ratio by forming the auxiliary capacitor 908 between pattern 106 made of ITO and the pixel electrode 107. The laminated insulating layer (904, 905) is not between these two layers and thus would not appear to affect the capacity.

In addition, ZHANG et al. further teach that the auxiliary capacitor 908 allows the ITO pattern 106 to function as a shield for electrically shielding the pixel electrode 107 from the source line 105 such that cross-talk between the source line 105 and pixel electrode 107 may be suppressed.

Accordingly, the plural laminated films of ZHANG et al. neither affect the aperture ratio nor the cross-talk. Rather, it is the presence of ITO pattern 106 that affects aperture ratio and cross-talk. Therefore, the motivation for combining ZHANG et al. with SHIMADA et al. as offered by the Examiner would not lead

one of ordinary skill in the art to include a plurality of laminated films in an insulating layer.

Fourth, the teachings of ZHANG et al. teach away from combining ZHANG et al. with SHIMADA et al. Based on the teachings of ZHANG et al. to maximize the aperture ratio and prevent cross-talk, one of ordinary skill in the art would be motivated to overlap the edge of the pixel electrode with the source line to form a capacitance. Such teaching is opposite that to which is taught by SHIMADA et al. Specifically, SHIMADA et al. directly contacts the pixel electrode 140 with source line 132 as seen in Figure 28 of SHIMADA et al. such that no capacitance would be created.

Therefore, one would not be motivated to combine ZHANG et al. with SHIMADA et al. to render obvious the claims of the present application.

Arguments Concerning Dependent Claim 3

Claim 3 provides that the insulating films include a passivation film formed on a switching element, a color layer formed on the passivation film and a flattening film formed on the passivation film and color layer. Claim 3 also provides that the contact hole includes openings formed in the passivation film, the color layer and the flattening film respectively.

Applicants are unable to find reference to the color

layer, passivation film or a flattening film in ZHANG et al. SHIMADA et al. teach that the color layer 146 overlies the contact hole, not that the contact hole includes openings formed in the passivation film, the color layer and the flattening film as recited in claim 3.

Arguments Concerning Dependent Claim 7

Claim 7 provides that the black matrix has a wide portion overlapping a region in the pixel between the data line and the projecting portion. As seen in Figure 1 of the present application, for example, black matrix 16 has a wide portion 16a that overlaps projecting portion 12ba (of the scanning line).

As seen in Figure 27 of SHIMADA et al., the black matrix (light-shading layer 144) of SHIMADA et al. is L-shaped and neither has a wide portion nor does the black matrix overlap a region in the pixel between the data line and a projecting portion (of the scanning line).

The black matrix of ZHANG et al. is formed by the overlap of the gate line 104 (scanning line) and the pixel electrode 107. ZHANG et al. does not teach a wide portion of the black matrix. In addition, since element 104 defines the black matrix, element 104 cannot overlap itself and thus ZHANG et al. do not teach that the black matrix overlaps a region in the pixel between the data line and a projecting portion (of the scanning

line). Accordingly, neither of the references meets the limitations of claim 7.

Arguments Concerning Independent claim 13

Claim 13 provides that the black matrix has a wide portion overlapping a region in the pixel between the data line and the projecting portion. As set forth above, one of ordinary skill in the art would understand that the projecting portion extends from the scanning line.

As seen in Figure 27 of SHIMADA et al., for example, the black matrix 144 is substantially uniform and does not have a wide portion. In addition, as further seen in Figure 27, the black matrix 144 does not overlap the projecting portion (near 136) of the scanning line 104. In fact, the black matrix 144 of SHIMADA et al. does not appear to overlap any part of the pixel region between the data line 102 and the scanning line 104.

As set forth above, the black matrix of ZHANG et al. is defined by the overlap between the gate line 104 (scanning line) and the pixel electrode 107. In order for one element to overlap another element, there must be two distinct elements. ZHANG et al. teach only a single element, the black matrix, which itself is formed by the overlap of the gate line 104 and the pixel electrode 107. Such element cannot overlap itself to meet the

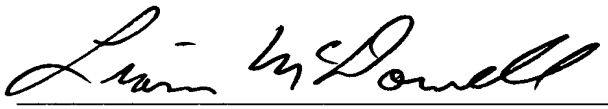
limitations of claim 13. Accordingly, the proposed combination of references would not render obvious claim 13.

In view of the foregoing, it follows that the rejection of claims 13-15 under 35 USC 112, second paragraph and the rejection of claims 1, 3-9 and 11-15 under 35 USC 103(a) as being unpatentable over SHIMADA et al. in view of ZHANG et al. are improper and should be reversed.

Reversal of these rejections is accordingly respectfully requested.

Respectfully submitted,

YOUNG & THOMPSON



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8. Appendix:

1. A liquid crystal display device comprising:

a pair of substrates;

a liquid crystal sealed between said pair of substrates;

a plurality of data lines and a plurality of scanning lines, being arranged on one surface of one of said pair of substrates and crossing each other;

a switching element having one end of a current path connected to the corresponding data line and a control end connected to the corresponding scanning line;

a wiring connected to the other end of the current path of said switching element;

an insulating layer, being formed on said wiring and having a contact hole through which an end portion of said wiring is exposed;

a pixel electrode, being formed on said insulating layer and electrically connected to the end portion of said wiring through the contact hole; and

an alignment film, being formed on said pixel electrode and in contact with said liquid crystal,

wherein said contact hole is formed at a position overlapping a region where disclination occurs, and

wherein said insulating layer is formed of a plurality of laminated insulating films,

the insulating films have openings individually which form said contact hole in a tapered shape as a whole.

2. (canceled)

3. The liquid crystal display device according to claim 1, wherein said insulating films includes a passivation film formed on the switching element, a color layer formed on said passivation film, and a flattening film formed on said passivation film and color layer,

said contact hole includes openings formed in the passivation film, the color layer, and the flattening film, respectively, and

the openings being formed in a tapered shape as a whole.

4. The liquid crystal display device according to claim 1, wherein said wiring is made of a light shielding material, and

said contact hole and at least a part of said region where disclination occurs are shielded by said wiring.

5. The liquid crystal display device according to claim 1, wherein the scanning lines and the data lines bounds a plurality of pixels each having said contact hole,

said contact hole in the pixel is provided at a downstream in a rubbing direction with respect to the switching element of other pixel adjacent to the pixel.

6. The liquid crystal display device according to claim 1, wherein said scanning line has a projecting portion overlapping at least one of said contact hole and said region where disclination occurs and shielding light.

7. The liquid crystal display device according to claim 4, further comprising a black matrix overlapping said data lines, wherein said black matrix has a wide portion overlapping a region in the pixel between said data line and the projecting portion.

8. The liquid crystal display device according to claim 4, wherein said projecting portion forms electrostatic capacitance between the wiring.

9. A liquid crystal display device manufacturing method, the liquid crystal display device comprising a thin film transistor, a wiring connected to said thin film transistor, a pixel electrode electrically connected to said wiring, and an alignment film formed on said pixel electrode, comprising steps of:

forming an insulating layer overlying the thin film transistor and the wiring;

forming a contact hole in the insulating layer through which an end portion of said wiring is exposed;

forming the pixel electrode on the insulating layer connected electrically with the wiring through the contact hole; and

forming the alignment film on the pixel electrode,

wherein the step of forming the contact hole comprising a step of forming the contact hole in a position overlapping a region where disclination occurs, and

wherein the insulating layer includes a plurality of laminated insulating films,

the step of forming the contact hole comprising a step of forming openings in the plurality of the insulating films respectively.

10. (canceled)

11. A liquid crystal display device manufacturing method according to claim 9, the insulating layer including a passivation film formed on the switching element, a color layer formed on said passivation film, and a flattening film formed on said passivation film and color layer,

the step of forming the contact hole comprising a step of forming openings in the passivation film, the color layer, and the flattening film, respectively, thereby forming the contact hole in a tapered shape as a whole.

12. The liquid crystal display according to claim 7, wherein said black matrix overlaps an entirety of said data lines.

13. A liquid crystal display device comprising:

a pair of substrates;

a liquid crystal sealed between said pair of substrates;

a plurality of data lines and a plurality of scanning lines, being arranged on one surface of one of said pair of substrates and crossing each other;

a switching element having one end of a current path connected to the corresponding data line and a control end connected to the corresponding scanning line;

a wiring connected to the other end of the current path of said switching element;

an insulating layer, being formed on said wiring and having a contact hole through which an end portion of said wiring is exposed;

a pixel electrode, being formed on said insulating layer and electrically connected to the end portion of said wiring through the contact hole;

an alignment film, being formed on said pixel electrode and in contact with said liquid crystal; and

a black matrix overlapping said data lines,

wherein said black matrix has a wide portion overlapping a region in the pixel between said data line and the projecting portion,

wherein said contact hole is formed at a position overlapping a region where disclination occurs, and

wherein said wiring is made of a light shielding material, and

said contact hole and at least a part of said region where disclination occurs are shielded by said wiring.

14. The liquid crystal display device according to claim 13, wherein said insulating layer is formed of a plurality of laminated insulating films,

the insulating films have openings individually which form said contact hole in a tapered shape as a whole.

15. The liquid crystal display device according to claim 14, wherein said insulating films includes a passivation film formed on the switching element, a color layer formed on said passivation film, and a flattening film formed on said passivation film and color layer,

said contact hole includes openings formed in the passivation film, the color layer, and the flattening film, respectively, and

the openings being formed in a tapered shape as a whole.

13. (marked-up) A liquid crystal display device comprising:

a pair of substrates;

a liquid crystal sealed between said pair of substrates;

a plurality of data lines and a plurality of scanning lines, being arranged on one surface of one of said pair of substrates and crossing each other;

a switching element having one end of a current path connected to the corresponding data line and a control end connected to the corresponding scanning line;

a wiring connected to the other end of the current path of said switching element;

an insulating layer, being formed on said wiring and having a contact hole through which an end portion of said wiring is exposed;

a pixel electrode, being formed on said insulating layer and electrically connected to the end portion of said wiring through the contact hole;

an alignment film, being formed on said pixel electrode and in contact with said liquid crystal; and

a black matrix overlapping said data lines,

wherein said black matrix has a wide portion overlapping a region in the pixel between said data line and [[the]] a projecting portion extending from said scanning line,

wherein said contact hole is formed at a position overlapping a region where disclination occurs, and

wherein said wiring is made of a light shielding material, and said contact hole and at least a part of said region where disclination occurs are shielded by said wiring.